DOCUMENTED CHROMOSOME NUMBERS 1998:1. CHROMOSOME NUMBERS IN *CAREX* SECTION *OVALES* (CYPERACEAE): ADDITIONS, VARIATIONS, AND CORRECTIONS

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ABSTRACT

Chromosome counts for 14 species of *Carex* section *Ovales* are documented completing at least a single report for each of the over 40 species known for eastern North America. The haploid numbers in this report ranged from $n = 24$ to $n = 42$. Counts for *Carex feta*, *C. muskingumensis*, *C. oronensis*, and *C. tetrastachya* were determined for the first time and six aneuploid (sensu lato) series are indicated. The only previously published counts for *C. adusta*, *C. argyrantha*, and *C. foenea* (*C. aenea*) were found to be incorrect.

RESUMEN

Se documentan los recuentos de 14 especies de *Carex* sección *Ovales* completando al menos una cita de las más de 40 especies conocidas del este de América del Norte. Los números haploides varían de $n = 24$ hasta $n = 42$. Se hacen por primera vez recuentos de *Carex feta*, *C. muskingumensis*, *C. oronensis*, y *C. tetrastachya* y se indican seis series aneuploides (sensu lato). Los únicos recuentos previos de *C. adusta*, *C. argyrantha*, y *C. foenea* (*C. aenea*) se ha encontrado que son incorrectos.

INTRODUCTION

Carex section *Ovales* is a large, coherent group of sedges with a center of diversity in North America. At least 40 species occur east of the Rocky Mountains and about as many species occur from the Rocky Mountains westward (Mastrogiuseppe et al. in review). Numerous karyological studies over the past 50 years (Whitkus 1991) have shown much chromosomal variation at the sectional, species, and population level. Even individual plants may have some cell to cell changes in karyotype. Much of this variation is thought to be the consequence of polycentric chromosomes with diffuse centromeres (Grant 1981). Polycentric chromosomes have the ability to fragment or fuse with other chromosome pieces and still retain the potential of completing

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normal movements during mitosis and meiosis. In spite or because of this variation, chromosome data have been informative in understanding the taxonomy and probable phylogenetic relationships among these species (Rothrock & Reznicek 1996a). And previously unrecognized species, such as *Carex ozarkana* and *C. molestiformis*, have been revealed to have distinctive chromosome numbers (Rothrock & Reznicek 1996b; Reznicek & Rothrock 1997).

As part of ongoing taxonomic studies of eastern North American species of *Carex* section *Ovales* and especially as part of the Flora of North America project, an effort was made to complete a karyological survey of all species which occur in eastern North America and, where possible, to capture additional intraspecific variability. This update documents the karyotypes of 40 plants from 14 species.

MATERIALS AND METHODS

As described previously (Rothrock & Reznicek 1996a), living plants were collected in the field during their fruiting stage and cultivated in a sand-peat-perlite medium under greenhouse conditions. In this study, two species, *C. praticola* and *C. xerantica*, were grown from seed taken from herbarium specimens. Cold treatment was used to stimulate the production of new inflorescences by the following spring. Immature spikes were preserved in methanol, chloroform, propionic acid (6:3:2). Within the subsequent 72 hours, anthers were dissected from the spikes and squashed in 2% lactic-acetic-orcein (Cooperrider & Morrison 1967). Meiosis I chromosome figures were examined from five or more pollen mother cells. Photographs and drawings were made with a Nikon Labophot-2 microscope using phase contrast at 1000x magnification.

Voucher specimens were typically prepared at the time of field collection or occasionally from fruiting greenhouse material. Vouchers, on deposit at the University of Michigan Herbarium (MICH), include photomicrographs and drawings of countable figures.

RESULTS AND DISCUSSION

The chromosome counts for the 14 species reported in this study ranged from $n = 24$, the lowest now known for section *Ovales* (Whitkus 1991), to $n = 42$ (Table 1). For six of the species intraspecific variation in chromosome number is reported. Five counts published by Löve and Löve (1981) are clearly at odds with our results and, given the often subtle differences between species, likely indicate faulty identification of the plant being examined.

Carex adusta F. Boott.—Our material from Washington Co., Maine, comes from near the eastern extreme of the distribution of *C. adusta*. Its $n = 39$

TABLE 1. New and published chromosome numbers for select species of *Carex* section *Ovales*.

Species	*n*	Location:Voucher or Reference
Carex adusta F. Boott	39	Washington Co., ME: A.A.R 10560
	32*	Löve & Löve 1981
Carex argyrantha Tuckerman	40	Hancock Co., ME: P.E.R. 3479
	40	Washington Co., ME: A.A.R. 10087
	40	Centre Co., PA: P.E.R. 3494
	40	Wahl 1940
	32*	Löve & Löve 1981
Carex brevior (Dewey) Mackenzie	24	Kaufman Co., TX: A.A.R.10345b
	24+IV	Kaufman Co., TX: A.A.R. 10345c
	26	Kaufman Co., TX: A.A.R. 10345a
	28	Christian Co., IL: P.E.R. 3545
	30	Lonoke Co., AR: P.E.R. 2885
	30+IV	Coahoma Co., MS: Bryson 14829
	32	Fayette Co., IL: P.E.R. 3540
	32	Pulaski Co., AR: P.E.R. 2902
	34	Löve & Löve 1981
Carex feta L.H. Bailey	33	Lane Co., OR: Wilson 7869
Carex faenea Willd.	41	Hancock Co., ME: P.E.R. 3480
	41	Strafford Co., NH: P.E.R. 3478
	42	Hancock Co., ME: P.E.R. 3480
	32*	Löve & Löve 1981
Carex hyalina F. Boott	37	Morris Co., TX: A.A.R. 8489
	37	Rothrock & Reznicek 1996a
Carex longii Mackenzie	29	Cumberland Co., TN: P.E.R. 3638
	28+IV	Rothrock & Reznicek 1996a
	31	Rothrock & Reznicek 1996a
Carex merritt-fernaldii Mackenzie	37	Strafford Co., NH: P.E.R. 3475
	34*	Löve & Löve 1981
	35	Tanaka 1942
Carex molesta Bright	34	Bolivar Co., MS: Bryson 12209
	34	White Co., IN: P.E.R. 3356
	35	Grant Co., IN: P.E.R. 2482
	35	Macon Co., MO: P.E.R. 3567.5
	34	Wahl 1940
	34*	Löve & Löve 1981
Carex muskingumensis Schwein.	40	Huntington Co., IN: P.E.R. 2132
Carex oronensis Fernald	37	Hancock Co., ME: P.E.R. 3481
	37	Penobscot Co., ME: P.E.R. 3483
Carex praticola Rydb.	39	Thunder Bay District, Ontario: Oldham 17731a
	38, 39	Packer & Whitkus 1982
	38, 39	Whitkus 1991
	32*	Löve & Löve 1981
Carex tetrastachya Scheele	30+III	Kaufman Co., TX: A.A.R. 10344
	32	Zavala Co., TX: Wipff 2915
	32	Brazos Co., TX: Jones 12345a
	33	Brazos Co., TX: Jones 12345b
	33	Burleson Co., TX: A.A.R. 10421
	33	Jefferson Co., TX: A.A.R. 10411
Carex xerantica L.H. Bailey	34	Thunder Bay District, Ontario: Oldham 17732
	34	Löve & Löve 1981

* problematic, unvouchered reports; see text

disagrees with the $n = 32$ listed by Löve and Löve (1981). Unfortunately many Löve and Löve chromosome counts for *Carex* section *Ovales*, including this one, have no known, extant voucher specimens. We suspect, however, that their $n = 32$ count may be based upon an individual belonging to some other species, perhaps *C. brevior* (Dewey) Mackenzie.

Carex argyrantha Tuckerman.—Based upon single plants from 3 localities, this species had a consistent $n = 40$. Wahl (1940) published a count of $n = 40$ for this species under the misapplied name *C. foenea*. Löve and Löve (1981) incorrectly attribute an $n = 32$ to this species. Their material came from a Manitoba source which lies outside the range of *C. argyrantha*. Unfortunately no voucher is known for their count.

Carex brevior (Dewey) Mackenzie.—Our material (10 plants) gave a surprisingly broad range of chromosome counts, from $n = 24$ to 32. Morphologically the species is variable but we were unable to correlate any particular phenotype with chromosome count. We thus have no reason as yet to suspect that 2 or more sibling species are hidden within this taxon. The lowest counts, $n = 24$, 24 + IV, and 26 are from unusually robust individuals collected in Kaufman Co., Texas. The $n = 30$ individual was noteworthy in having clear nervation on the dorsal face of the perigynia. A previous report for *Carex brevior* (with voucher specimen documentation available) is $n = 34$ (Löve & Löve 1981). This report is plausible, though the number remains unconfirmed.

Carex feta L.H. Bailey.—This species, from western North America, had an $n = 33$. Given the size and shape of the perigynia and achenes as well as the clear collar at the orifice of the leaf sheath, we suspect that *C. feta* is most closely related to *C. festucacea* Schk. ex Willd. found in eastern North America. The later species has a chromosome range of $n = 33 + III$, 34, and 35 (Wahl 1940; Rothrock & Reznicek 1996a).

Carex foenea Willd.—Our material (4 plants) had $n = 41$ and 42. In fact, the short aneuploid series was observed within the population from Hancock Co., Maine. Many taxonomic treatments (e.g. Fernald 1950) have incorrectly called this taxon *C. aenea* Fern. Löve and Löve (1981) published an $n = 32$ for *C. aenea* for material collected from near Brandon, Manitoba. No voucher specimen from this locality could be found. On the other hand, their voucher from Maskwa rapids, Manitoba (Löve & Löve 5512, WIN!) is a specimen of *C. foenea* and the annotation label indicates that the chromosome count was "$2n = 64$." Unfortunately this voucher was intended for their report of *C. tenera*, a species with $n = 26$ to 28 (Wahl 1940; Rothrock & Reznicek, unpublished data).

The relatively high chromosome number for *C. foenea* compares favorably to that of several other species possessing long pistillate scales. These

include *C. adusta* (n = 39), *C. argyrantha* (n = 40), and perhaps *C. silicea* Olney (n = 37, 38).

Carex hyalina F. Boott.—This specimen from the southwestern extreme of the species' range had an n = 37. Our previous report (Rothrock & Reznicek 1996a) for the rare *C. hyalina,* from the northern portion of its range in Mississippi, also provided an n = 37.

Carex longii Mackenzie.—Previous work (Rothrock & Reznicek 1996a) found n = 28 + IV and 31 for plants from the coastal plain of the southeastern US and from southern Michigan. This plant with n = 29 comes from the Cumberland Mountain region of Tennessee.

Carex merritt-fernaldii Mackenzie.—Given a count by Tanaka (1942) of n = 35, our result of n = 37 suggests possible aneuploidy for this species. Löve and Löve (1981) offer an undocumented count of $2n$ = 68. However their count must be in error since the plant material came from Melita in extreme southwestern Manitoba, well outside the known range for *C. merritt-fernaldii* in that province.

Carex merritt-fernaldii often is morphologically confused with *C. brevior.* The differences in chromosome condition, however, reinforce its recognition at the species level.

Carex molesta Bright.—Previous work found n = 34 for this taxon (Wahl 1940). Löve and Löve (1981) also found n = 34 for undocumented material from Manitoba where, as far as we know, *C. molesta* does not occur. We confirm n = 34 but also found an aneuploid variation of n = 35.

Carex muskingumensis Schwein.—The count of n = 40 (based upon 2 plants) is the first for this species. For a member of *Carex* section *Ovales*, *C. muskingumensis* is quite distinctive. The stiff inflorescence, spikes, and lanceolate perigynia are unusually large. The vegetative culms have numerous evenly spaced leaves reminiscent of the *C. tribuloides* group (with n = 32 & 35), the mostly likely near relative of *C. muskingumensis.*

Carex oronensis Fernald.—The counts of n = 37 are the first for this rare endemic of the Penobscot River valley in central Maine. Dibble (1991) hypothesizes that the European *C. ovales* is a near relative. However, this is not supported by the numerous chromosome counts for *C. ovalis* which range from n = 32 to 34 (Whitkus 1991). We are unable to suggest possible close affinities between *C. oronensis* and other species in eastern North America.

Carex praticola Rydb.—Primarily a species of western North America, this plant comes from a disjunct southern outlier of the species' natural distribution. Its n = 39 is identical to that of Packer and Whitkus (1982) and Whitkus (1991), who additionally reported n = 38. The unvouchered re-

port of $n = 32$ by Löve and Löve (1981) is highly suspect.

Carex tetrastachya Scheele.—Formerly known as *C. brittoniana*, *C. tetrastachya* displays an aneuploid series. Among the material available, we observed $n = 30 + III$ (1 plant), 32 (3 plants), 33 (4 plants). Correll and Johnson (1970) suggest that this taxon and *C. hyalina* are most closely related. Vegetatively we especially find the two to be quite distinctive and the *C. hyalina* counts of $n = 37$ do not immediately suggest a close affinity.

Carex xerantica L.H. Bailey.—Our plant from a disjunct and eastern outlier of the species in Ontario yielded an $n = 34$. This confirms an unvouchered (but geographically plausible) report by Löve and Löve (1981) for this northern species.

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